

CORRESPONDENCE/MEMORANDUM**State of Wisconsin**

DATE: July 23, 2020

TO: Sarah Donoughe – Green Bay Service Center

FROM: Wade Strickland – WY/3

*Deane F. Gil for WY*SUBJECT: Water Quality-Based Effluent Limitations for the Little Chute Waterworks
WPDES Permit No. WI-0065366-02-0

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using Chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Little Chute Waterworks in Outagamie County. This water treatment system discharges to the Fox River, located in the Fox River - Appleton Watershed in the Lower Fox River Basin. This discharge is in the Lower Fox River Basin (LFRB) which has a TMDL that was approved by EPA on May 18, 2012. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis for outfalls 001 and 002:

Parameter	Daily Maximum	Daily Minimum	Monthly Average	Annual Total	Footnotes
Softener Regeneration					1
Flow Rate					1
TSS	40 mg/L			437 lbs/yr	1, 2
pH	9.0 s.u.	6.0 s.u.			1
Phosphorus				53 lbs/yr	2
Chlorine (Total Residual)	38 µg/L				
Chloride					3
Hardness (Total as CaCO ₃)					4
Copper (Total Recoverable) Outfall 001	7.1 µg/L				5
Outfall 002	0.0017 lbs/day 6.8 µg/L 0.0014 lbs/day				

Footnotes:


1. No changes from the current permit
2. Phosphorus and TSS mass limits given as annual totals for the combined outfalls are based on the Total Maximum Daily Load (TMDL) for the LFRB to address water quality impairments within the TMDL area. The availability of reserve capacity WLA for TSS and TP in the LFRB TMDL has been reviewed by the Department and has been granted to the facility equal to the annual totals. Monitoring is recommended such that rolling 12-month sums for each constituent can be calculated for both outfalls.
3. Monitoring is recommended to ensure that 11 sample results are available at the next permit issuance to meet the data requirements of s. NR 106.85, Wis. Adm. Code.
4. Quarterly hardness monitoring is recommended because of the relationship between effluent hardness and daily maximum limits based on acute toxicity criteria.
5. The mass limit is based on the concentration limit and the calculated daily maximum design discharge for the outfall. Compliance with the mass limits should be based on the discharge from the combined Outfalls for the day.

Following the October 29, 2019 Department's WET Program Guidance Document, no WET testing is required. The recommended limits meet the expression of limits requirements in ss. NR 106.07 and NR 205.065(7) and additional limits are not required.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Michael Polkinghorn at (608) 266-3906 (Michael.Polkinghorn@wisconsin.gov) or Diane Figiel at (608) 264-6274 (Diane.Figiel@wisconsin.gov).

Attachments (3) – Narrative, Map, & Data Source Table

PREPARED BY: Michael A. Polkinghorn, E.I.T. – Water Resources Engineer

APPROVED BY:  Date: 07/23/2020
Diane Figiel, PE,
Water Resources Engineer

E-cc: Roy Van Gheem, P.E., Wastewater Engineer – Green Bay Service Center
Heidi Schmitt-Marquez, Northeast Region Wastewater Supervisor – Green Bay Service Center
Diane Figiel, P.E., Water Resources Engineer – WY/3
Keith Marquardt, Water Resources Management Specialist – Oshkosh Service Center
Emma Lorenzen, Wastewater Engineer – WY/3

**Water Quality-Based Effluent Limitations for
Little Chute Waterworks**

WPDES Permit No. WI-0065366-02-0

Prepared by: Michael A. Polkinghorn, E.I.T.

PART 1 – BACKGROUND INFORMATION

Facility Description:

The permittee operates ion-exchange water softening systems at Pump Houses #1 and #2. When a softener is regenerated the first action of the regeneration cycle is a backwash. The backwash wastewater does not contain salt – which is present in other portions of the regeneration cycle – and thus may be suitable for discharge to surface water. The generated brine is stored onsite in a tank where it is discharged to the sanitary sewer and is received by the Heart of the Valley wastewater treatment facility.

Pump House #2 (Outfall 002) is equipped with air-pressure actuated valves (operated by the system control and data acquisition (SCADA) system) which direct the backwash wastewater to a storm sewer, and the remaining wastewater from softener regeneration to a sanitary sewer. These pressure actuated valves were installed prior to July 2015. The flow direction system, which diverts backwash water to the storm sewer, has several fail safe mechanisms incorporated into it, such that if any mechanisms fail, flow is sent to the sanitary sewer. There are three to five regeneration cycles per day. Each backwash cycle lasts approximately 15 minutes and discharges at a rate of approximately 325 gallons per minute.

The storm sewer discharge by Outfall 002 flows to the Fox River by South Monroe Street. The discharge is noncontinuous on an as needed basis and occurred for approximately 1,168 days (256 days/yr average) from July 2015 – January 2020.

Pump House #1 (Outfall 001) was modified to have similar operations as Pump House #2 where construction was completed by July 2016. The one difference in operation between the pump houses is Pump House #1 can run up to 6 regeneration cycles per day. The storm sewer discharge by Outfall 001 flows to the north bank of the Fox River at the south end of Van Buren Street in Doyle Park. The discharge is noncontinuous on an as needed basis and occurred for approximately 662 days (255 days/yr average) from July 2017 – January 2020.

Attachment #2 is a map of the area showing the approximate locations of Outfall 001 and Outfall 002.

Existing Permit Limitations: The current permit, expiring on 06/30/2020, includes the following effluent limitations and monitoring requirements for Outfalls 001 and 002:

Parameter	Daily Maximum	Daily Minimum	Footnotes
Softener Regeneration			1
Flow Rate			1
TSS	40 mg/L		2
pH	9.0 s.u.	6.0 s.u.	
Chloride	1,500 mg/L		3

Footnotes:

1. Monitoring only
2. Limits are based on best professional judgment based on the “Potable Water Treatment and/or Conditioning” general permit.
3. These are WQBELs for chloride based on best professional judgment if brine were discharged to the Fox River. A mass limit of 390 lbs/day applies to Outfall 001 based on the estimated daily maximum flowrate of 31,500 gal/day and a mass limit of 330 lbs/day applies to Outfall 002 based on the estimated daily maximum flowrate of 26,250 gal/day.

Receiving Water Information:

- Name: Fox River
 - WBIC: 117900
 - Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm water sport fish community, non-public water supply. Cold Water and Public Water Supply criteria are used for bioaccumulating compounds of concern, because the discharge is within the Great Lakes basin.
 - Low Flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The following 7-Q₁₀ and 7-Q₂ values are from USGS for Station NE 1/4, Section 35, T21N – R17E at Appleton. This is approximately 5.1 mi upstream of Outfalls 001 and 002.
 - 7-Q₁₀ = 930 cfs (cubic feet per second)
 - 7-Q₂ = 1,550 cfs
 - 90-Q₁₀ = 1,240 cfs
 - Harmonic Mean Flow = 3,040 cfs using a drainage area of 5,950 mi².
- It should be noted that the previous WQBEL memorandum dated January 2015 used USGS low-flow data at Wrightstown approximately nine miles downstream of Outfalls 001 and 002. The Appleton station is used instead in this evaluation to have more representative low-flows of the Fox River before influence by Outfalls 001 and 002.
- Hardness = 182 mg/L as CaCO₃. This value represents the geometric mean of data (n = 61) from the Fox River at Appleton from January 1998 – June 2015. This value is from a collection of mean hardness values for the Fox and Wolf River Basins.
 - % of low flow used to calculate limits in accordance with s. NR 106.06 (4) (c) 5., Wis. Adm. Code: 25%
 - Source of background concentration data: Metals data from the Wolf River in New London is used for this evaluation because there is no data available for the Fox River. The Wolf River is within the same ecological landscape so ambient water quality characteristics are expected to be similar. Chloride data from the Fox River in Appleton is also used for this evaluation. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen and phosphorus are described later.
 - Multiple dischargers: There are several other dischargers to the Fox River however they are not in the immediate vicinity and the mixing zones do not overlap. Therefore, the other dischargers do not impact this evaluation.
 - Impaired water status: The Fox River is listed under the Clean Water Act (CWA) Section 303(d) and is impaired by phosphorus and polychlorinated biphenyls (PCBs). This surface water is included in the Lower Fox River Basin (LFRB) TMDL for phosphorus and TSS.

Effluent Information:**Outfall 001:**

Flow Rate(s):

Annual average actual = 0.0168 MGD (Million Gallons per Day) (2018)

This flow value is based on a calendar average excluding non-reported or zero flow days.

Daily maximum design = 0.0293 MGD (325 gpm * 15 min/cycle * 6 cycles/day * 1/10⁶)

For reference, the actual average flow from July 2015 – January 2020 was 0.0166 MGD. It should be noted that flow averages do not take into account days discharge did not occur.

- Hardness = 21 mg/L as CaCO₃. This value represents the geometric mean of data (n = 4) submitted in the permit application from October 2019 – December 2019.

Outfall 002:

Flow Rate(s):

Annual average actual = 0.0133 MGD (Million Gallons per Day) (2018)

This flow value is based on a calendar average excluding non-reported or zero flow days.

Daily maximum design = 0.0244 MGD (325 gpm * 15 min/cycle * 5 cycles/day * 1/10⁶)

For reference, the actual average flow from July 2015 – January 2020 was 0.0118 MGD. It should be noted that flow averages do not take into account days discharge did not occur.

- Hardness = 20 mg/L as CaCO₃. This value represents the geometric mean of data (n = 4) submitted in the permit application from October 2019 – December 2019.

Outfalls 001 and 002:

- Acute dilution factor used in accordance with s. NR 106.06 (3) (c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water Source: Village of Little Chute Waterworks
- Additives: None at pump houses but water source uses chlorine disinfection. This is not explicitly stated in the permit application but is evident in chlorine sample for Outfall 001.
- Effluent characterization: This facility is categorized as a municipal waterworks, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus Ammonia, Hardness, and Phosphorus.

Outfall	001	002
Sample Date	Copper µg/L	Copper µg/L
10/24/2019	<3.4	<3.4
12/02/2019	25.4	18.2
12/05/2019	36.3	27.6
12/10/2019	<3.4	27
Mean	15.4	15.6

“<” means that the pollutant was not detected at the indicated level of detection. The mean concentration was calculated using zero in place of the non-detected results.

Attachment #1

Outfall	001	002
	Chloride mg/L	Chloride mg/L
1-day P ₉₉	80.71	28.20
4-day P ₉₉	43.93	17.39
30-day P ₉₉	21.15	11.94
Mean	11.92	9.42
Std	17.35	5.39
Sample size	51	62
Range	4.10 – 130	4.10 – 30.9

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled “MEAN EFFL. CONC.”. It should be noted that hexane, lead, zinc, arsenic, cadmium, chromium, and nickel samples resulted in non-detect values and are not included in the tables. The “<” sign was missing on the permit application however it was confirmed with the operator that the results were less than the level of detections. Hexane was also not detected in the effluent but there are no applicable surface water criteria or secondary values available.

The following table presents the average concentrations and loadings at Outfall 001 from July 2017 – January 2020 and Outfall 002 from July 2015 – January 2020 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

Outfall	001		002	
	Average Measurement	Average Mass Discharged	Average Measurement	Average Mass Discharged
TSS	1.8 mg/L		6.7 mg/L	
pH field	7.5 s.u.		7.5 s.u.	
Chloride	11.92 mg/L	1.8992 lbs/day	9.42 mg/L	0.9278 lbs/day

*Results below the level of detection (LOD) were included as zeroes in calculation of the average.

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P₉₉) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q₁₀:

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Adm. Code (September 1, 2016)

Attachment #1

require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q₁₀ receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards.

$$\text{Limitation} = \frac{(\text{WQC}) (Q_s + (1-f) Q_e) - (Q_s - f Q_e) (C_s)}{Q_e}$$

Where:

WQC = Acute toxicity criterion or secondary acute value according to ch. NR 105

Q_s = average minimum 1-day flow which occurs once in 10 years (1-day Q₁₀)

if the 1-day Q₁₀ flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q₁₀).

Q_e = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

C_s = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

As a rule of thumb, if the receiving water is effluent dominated under low stream flow conditions, the 1-Q₁₀ method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is not the case for Little Chute Waterworks and the limits are set based on two times the acute toxicity criteria.

The following tables list the calculated water quality-based effluent limitations for this discharge along with the results of effluent sampling for all the detected substances. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC):

RECEIVING WATER FLOW = 744 cfs, (1-Q₁₀ (estimated as 80% of 7-Q₁₀)), as specified in s. NR 106.06 (3) (bm), Wis. Adm. Code.

Outfall 001

SUBSTANCE	REF. HARD. mg/L	ATC	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Chlorine		19.0	38.1	7.61	330		330
Copper	21	3.6	7.1	1.42	15.43		36.3
Chloride (mg/L)		757	1,514			80.71	130

Outfall 002

SUBSTANCE	REF. HARD. mg/L	ATC	MAX. EFFL. LIMIT*	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P ₉₉	1-day MAX. CONC.
Chlorine		19.0	38.1	7.61	250		250
Copper	20	3.4	6.8	1.36	15.6		24.8
Chloride (mg/L)		757	1,514			28.20	30.9

* The 2 × ATC method of limit calculation yields a more restrictive limit than consideration of ambient concentrations and 1-Q₁₀ flow rates per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC):

RECEIVING WATER FLOW = 233 cfs ($\frac{1}{4}$ of the 7-Q₁₀), as specified in s. NR 106.06 (4) (c), Wis. Adm. Code
Outfall 001

SUBSTANCE	REF. HARD. mg/L	CTC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Chlorine		7.28		65,166	13,033	330	
Copper	182	17.28	0.96	146,133	29,227	15.43	
Chloride (mg/L)		395	15.2	3,399,772			43.93

Outfall 002

SUBSTANCE	REF. HARD. mg/L	CTC	MEAN BACK- GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P ₉₉
Chlorine		7.28		65,166	13,033	250	
Copper	182	17.28	0.96	146,133	29,227	15.6	
Chloride (mg/L)		395	15.2	3,399,772			17.39

Monthly Average Limits based on Wildlife Criteria (WC):

The effluent characterization did not include any effluent sampling results for substances for which WC exist.

Monthly Average Limits based on Human Threshold Criteria (HTC):

The effluent characterization did not include any effluent sampling results for substances for which HTC exist.

Monthly Average Limits based on Human Cancer Criteria (HCC):

The effluent characterization did not include any effluent sampling results for substances for which HCC exist. In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because substances for which HCC exists, were not detected in the effluent, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations:

Based on a comparison of the effluent data and calculated effluent limitations, effluent limitations are required for chlorine and copper.

Chlorine (Total Residual) – Considering available effluent data for Outfall 001 from the current permit term (October 2019), the daily maximum value and mean effluent concentration are both 330 µg/L. Similarly, using available effluent data for Outfall 002 from the current permit term (October 2019), the daily maximum value and mean effluent concentration are both 250 µg/L. Both outfalls exceed the calculated daily maximum WQBEL for chlorine. Therefore, a daily maximum effluent limit of 38 µg/L is recommended during the reissued permit term applied to both outfalls. Due to revisions to s. NR 106.07(2), Wis. Adm. Code, mass limitations are no longer required. Weekly average limitations are not needed based on reasonable potential as the daily maximum limitations will provide adequate protection of the resource.

Copper (Total Recoverable) – Considering available effluent data for Outfall 001 from the current permit term (October 2019 – December 2019), mean effluent concentration is 15.43 µg/L, with a daily maximum concentration of 36.3 µg/L. Similarly, using available effluent data for Outfall 002 from the current permit term (October 2019 – December 2019), mean effluent concentration is 15.6 µg/L, with a daily maximum concentration of 24.8 µg/L. The mean effluent concentration and the daily maximum concentration of the effluent data for both outfalls exceed the calculated daily maximum limit. Therefore, the daily maximum limit of 7.1 µg/L is recommended for Outfall 001 during the reissued permit term. Similarly, the daily maximum limit of 6.8 µg/L is recommended for Outfall 002 during the reissued permit term.

The acute mass limitation for Outfall 001 is 0.0017 lbs/day is based on the concentration limit and the peak daily design flow rate of 0.0293 MGD ($7.1 \mu\text{g/L} * 0.0293 \text{ MGD} * 8.34/1000$) in accordance with s. NR 106.07(2)(a), Wis. Adm. Code. Similarly, the acute mass limitation for Outfall 002 is 0.0014 lbs/day is based on the concentration limit and the peak daily design flow rate of 0.0244 MGD ($6.8 \mu\text{g/L} * 0.0244 \text{ MGD} * 8.34/1000$).

Quarterly hardness monitoring is also recommended because of the relationship between hardness and daily maximum limits based on acute toxicity criteria.

Chloride – Considering available effluent data for Outfall 001 from the current permit term (July 2017 – October 2019), the 1-day P₉₉ chloride concentration is 80.71 mg/L, and the 4-day P₉₉ of effluent data is 43.93 mg/L. Similarly, available effluent data for Outfall 002 from the current permit term (July 2015 – October 2019), the 1-day P₉₉ chloride concentration is 28.20 mg/L, and the 4-day P₉₉ of effluent data is 17.39 mg/L. These effluent concentrations are below the calculated WQBELs for chloride, therefore no effluent limits are recommended during the reissued permit term.

The current permit has chloride limits based on a scenario where the high chloride water which is currently directed to the municipal sanitary sewer system were re-directed to the Fox River. This has not occurred and there are no plans to do this during the permit term. If this were the case, the chloride limits would need to be retained in the permit.

Chloride monitoring is recommended to ensure that 11 sample results are available at the next permit issuance to meet the data requirements of s. NR 106.85, Wis. Adm. Code.

Mercury – The permit application did not require monitoring for mercury because Little Chute Waterworks is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., Wis. Adm. Code, a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, “there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5).” It is not expected that there are exceedances of high-quality mercury concentrations in municipal waterworks. No monitoring is recommended during the reissued permit term.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOTAL SUSPENDED SOLIDS (TSS)

The LFRB TMDL report addresses TSS water quality impairments within the LFRB and provides wasteload allocations (WLAs) required to meet water quality standards in the TMDL area. The current permit has a daily maximum limit of 40 mg/L for both outfalls based on the “Potable Water Treatment and/or Conditioning” general permit. Given the fact that Little Chute Waterworks does not have a TSS WLA and must be allocated one in order to discharge TSS in the TMDL area, the TSS offset will be evaluated at this time.

Effluent Data:

TSS effluent data from each outfall are included in the table below. Outfall 001 was sampled from July 2015 – October 2020 while Outfall 002 was sampled from July 2017 – October 2019. The TSS sample of 60.00 mg/L (03/09/2016) for Outfall 002 was determined to be an outlier using the Grubb’s one-tailed test and was not used in calculation of the P₉₉ statistics.

	TSS Outfall 001 - mg/L	TSS Outfall 002 - mg/L
1-day P ₉₉	11	23
4-day P ₉₉	6.0	12
30-day P ₉₉	3.1	6.9
Mean	1.8	4.6
Std	2.3	4.6
Sample size	19	25
Range	0.95 – 11	0.95 – 16.2

The TSS offset needed in the form of a WLA will be based upon the current TSS effluent data of the facility as determined by the Department TMDL coordinators. The 30-day P₉₉ of effluent data is used over the overall average to capture potential effluent variability. The equation used is provided below:

$$WLA = \text{Current Discharge} * \text{Effluent Flowrate} * 8.34 * 365$$

Where:

Current Discharge = 30-day P₉₉ of pollutant in mg/L

Effluent Flowrate = Maximum actual annual average discharge flowrate in MGD

8.34 = Conversion factor to convert concentration and flowrate into lbs/day

365 = Conversion factor to convert lbs/day into lbs/yr

The following table includes the associated parameters and calculated WLAs needed for each outfall:

Parameter	Outfall 001	Outfall 002
Maximum Average Flow	0.0168 MGD	0.0133 MGD
30-day P ₉₉ TSS Conc.	3.1 mg/L	6.9 mg/L
WLA Needed	158.4 lbs/yr	278.4 lbs/yr
Total Offset	436.8 lbs/yr	

The total TSS WLA needed for Little Chute Waterworks is 436.8 lbs/yr equal to 1.2 lbs/day expressed as a maximum annual load and daily maximum load respectively. The daily WLAs equals the annual WLA divided by the number of days in the year. Therefore, the daily WLA is an annual average. Since the derivation of daily WLAs from annual WLAs does not take effluent variability or monitoring frequency into consideration, maximum daily WLAs from the LFRB TMDL should not be used directly as permit effluent limits.

The availability of reserve capacity WLA for TSS in the LFRB TMDL has been reviewed by the Department and has been granted to Little Chute Waterworks equal to the calculated WLA of 436.8 lbs/year. Because Little Chute Waterworks is a noncontinuous discharger, TSS limits will be set equal to the WLA as a maximum annual total during time periods when the discharge occurs.

Since wasteload allocations are expressed as annual loads (lbs/yr), permits with TMDL-derived monthly average permit limits should require the permittee to calculate and report rolling 12-month sums of total monthly loads for TSS. Rolling 12-month sums can be compared directly to the annual wasteload allocation. Because a monthly average limit is not recommended, monitoring is recommended such that monthly TSS can be calculated to generate the rolling 12-month sums.

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. Given the fact that the Little Chute Waterworks does not currently have ammonia nitrogen limits the need for limits is evaluated at this time.

Four samples for ammonia nitrogen were taken for each outfall from October 2019 – December 2019 and are included in the table below.

Sample Date	Ammonia Nitrogen Outfall 001 - mg/L	Ammonia Nitrogen Outfall 002 - mg/L
10/19/2019	0.68	<0.25
10/24/2019	0.62	0.62
12/10/2019	<0.14	<0.14
12/13/2019	<0.14	<0.14
Mean	0.33	0.16

*Results below the level of detection (LOD) were included as zeroes in calculation of the average.

Neither outfall has the reasonable potential to exceed any calculated ammonia nitrogen limit. Therefore, limits or monitoring are not recommended during the reissued permit term.

Attachment #1
PART 5 – PHOSPHORUS

Technology Based Phosphorus Limit:

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal waterworks facilities that discharge greater than 60 pounds of Total Phosphorus per month to comply with a 12-month rolling average limit of 1.0 mg/L, or an approved alternative concentration limit.

Because Little Chute Waterworks does not currently have an existing technology-based limit, the need for this limit in the reissued permit is evaluated. The permit application only required weekly phosphorus monitoring for three months during the current permit term which is not representative of a year of discharge from either outfall. The data available demonstrates that the annual monthly average phosphorus loading is less than 60 lbs/month for the combined outfalls, which is the threshold for municipal waterworks in accordance to s. NR 217.04(1)(a)2, Wis. Adm. Code, and therefore a technology-based limit is not required. In addition, the need for a WQBEL for phosphorus must be considered.

	Month	Average Phosphorus Concentration (mg/L)	Total Effluent Flow (Million Gallons)	Calculated Mass* (lbs/month)
Outfall 001	October 2019	0.52	0.270	1.2
Outfall 002	October 2019	0.55	0.177	0.8
	Total			2.0
Outfall 001	December 2019	0.57	0.282	1.3
Outfall 002	December 2019	0.59	0.204	1.0
	Total			1.2
			Average**	1.6

*Total P (lbs/month) = Monthly average (mg/L) × total flow (MG/month) × 8.34 (lbs/gallon)

Where total flow is the sum of the actual flow (in MGD) for that month

**Results below the level of detection (LOD) were included as zeroes in calculation of the average.

Water Quality-Based Effluent Limits (WQBEL):

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

The LFRB TMDL establishes TP and TSS wasteload allocations to reduce the loading in the entire watershed including WLAs to meet water quality standards for tributaries to the Lower Fox River. Therefore, WLA-based WQBELs are protective of immediate receiving waters and TP WQBELs derived according to s. NR 217.13, Wis. Adm. Code are not required.

Mass limits are required to prevent decreases in water quality in the TMDL area if WLAs relating to the constituents of concern in the TMDL are given to Little Chute Waterworks. It should be noted that Little Chute Waterworks is considered a “New Discharger” for phosphorus as described in s. NR 217.11(3) Wis. Adm. Code, in addition to, not having a WLA in the LFRB TMDL area. If a new discharger is

Attachment #1

proposing a discharge of phosphorus to a receiving or downstream water that is a phosphorus impaired water, the new discharger may not discharge phosphorus except as follows:

1. The new discharge of phosphorus is allocated part of the reserve capacity or part of the wasteload allocation in a US EPA approved TMDL;
2. The new discharger can demonstrate the new discharge of phosphorus will improve water quality in the phosphorus impaired segment; or
3. The new discharger can demonstrate that the new phosphorus load will be offset through a phosphorus trade or other means with another discharge of phosphorus to the 303 (d) listed water. The offset must be approved by the department and must be implemented prior to discharge.

Effluent Data:

Twelve samples for phosphorus were taken for each outfall from October 2019 – December 2019; with seven of the results less than the level of detection (reported as zero in the permit application). The detected results are included in the table below.

Sample Date	Total Phosphorus Outfall 001 - mg/L	Total Phosphorus Outfall 002 - mg/L
10/10/2019	0.49	0.58
10/17/2017	0.51	0.52
10/24/2019	0.55	0.60
12/02/2019	0.52	0.60
12/10/2019	0.57	0.58
Mean	0.53	0.58

*Results below the level of detection (LOD) were included as zeroes in calculation of the average

Calculated Offset:

The phosphorus offset needed in the form of a WLA will be based upon the current phosphorus effluent data of the facility as determined by the Department TMDL coordinators. The maximum sampled phosphorus concentration of effluent data is used in place of the overall average due to the limited dataset. The equation used is provided below:

$$WLA = Current\ Discharge * Effluent\ Flowrate * 8.34 * 365$$

Where:

Current Discharge = Maximum effluent sample in mg/L

Effluent Flowrate = Maximum actual annual average discharge flowrate in MGD

8.34 = Conversion factor to convert concentration and flowrate into lbs/day

365 = Conversion factor to convert lbs/day into lbs/yr

The following table includes the associated parameters and calculated offsets needed for each outfall:

Parameter	Outfall 001	Outfall 002
Maximum Average Flow	0.0168 MGD	0.0133 MGD
Maximum P Conc.	0.57 mg/L	0.60 mg/L
Offset Needed	29.1 lbs/yr	24.2 lbs/yr
Total Offset	53.3 lbs/yr	

Attachment #1

The total phosphorus offset needed for Little Chute Waterworks is 53.3 lbs/yr equal to 0.15 lbs/day expressed as a maximum annual load and daily maximum load respectively. The daily WLAs equals the annual WLA divided by the number of days in the year. Therefore, the daily WLA is an annual average. Since the derivation of daily WLAs from annual WLAs does not take effluent variability or monitoring frequency into consideration, maximum daily WLAs from the LFRB TMDL should not be used directly as permit effluent limits.

The availability of reserve capacity WLA for TP in the LFRB TMDL has been reviewed by the Department and has been granted to Little Chute Waterworks equal to the calculated WLA of 53.3 lbs/year. For the reasons explained in the April 30, 2012 paper entitled *Justification for Use of Monthly, Growing Season and Annual Average Periods for Expression of WPDES Permit Limits for Phosphorus Discharges in Wisconsin*, WDNR has determined that the phosphorus WQBELs set equal to WLAs would not be consistent with the assumptions and requirements of the TMDL. Because Little Chute Waterworks is a noncontinuous discharger, phosphorus limits will be set equal to the WLA as a maximum annual total during time periods when the discharge occurs.

Since wasteload allocations are expressed as annual loads (lbs/yr), permits with TMDL-derived monthly average permit limits should require the permittee to calculate and report rolling 12-month sums of total monthly loads for TP. Rolling 12-month sums can be compared directly to the annual wasteload allocation. Because a monthly average limit is not recommended, monitoring is recommended such that monthly TP can be calculated to generate the rolling 12-month sums.

PART 6 – THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

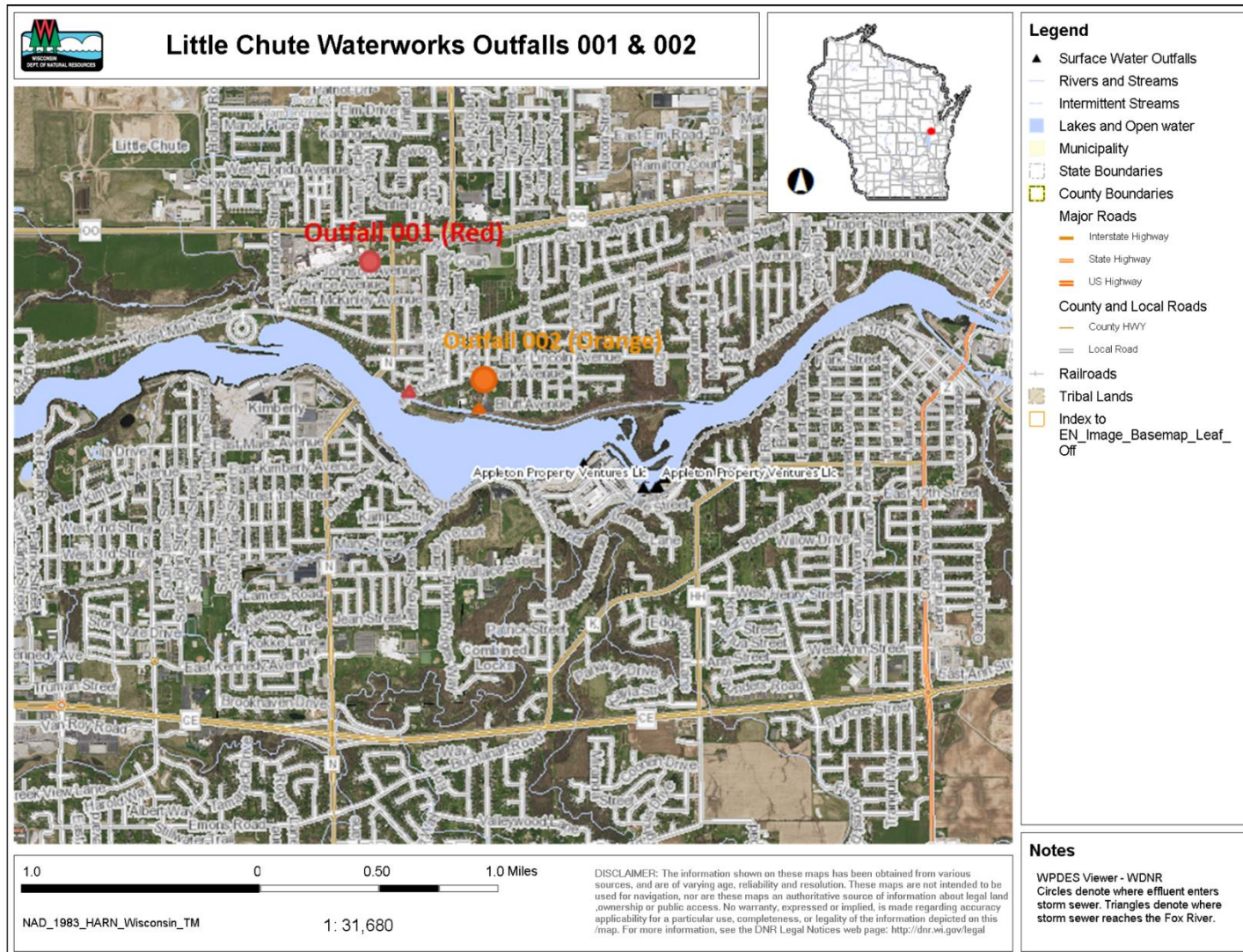
Due to the amount of upstream flow available for dilution in the limit calculation ($Q_s:Q_e > 20:1$), the lowest calculated limitation is 120° F (s. NR 106.55(6)(a), Wis. Adm. Code). The permit application required one temperature sample for each outfall in October 2019. The samples are 55 and 56° F for Outfall 001 and 002 respectively. Therefore, there is no reasonable potential for this municipal waterworks to exceed this limit at any time during the year. Monitoring or effluent limits are not recommended during the reissued permit term.

PART 7 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional

judgment of staff familiar with the discharge after consideration of the guidance in the WET Program Guidance Document (October 29, 2019).

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09 (2) (b), Wis. Adm Code.
- Chronic testing is usually not recommended where the ratio of the 7-Q₁₀ to the effluent flow exceeds 100:1 and acute testing is not typically recommended if the ratio exceeds 1000:1. For the Little Chute Waterworks, that ratio is approximately 35,803:1. With this amount of dilution, there is believed to be little potential for acute or chronic toxicity effects in the Fox River associated with the discharge from the Little Chute Waterworks, so the need for acute and chronic WET testing will not be considered further.



Attachment #3

Data	Source	Start Date	End Date	Sample Count	Notes
Receiving Water - Fox River					
WBIC	WPDES viewer	-	-	-	117900
Classification	Permit fact sheet, WPDES viewer	-	-	-	WWSF
Flow (Qs)	USGS Data - Station NE ¼ of Section 35; T21N – R17E (Appleton)	-	-	4	Low-flows changed for upstream values
Chloride	Fox River at Appleton, background chloride summary	Feb. 1982	Dec. 1996	98	Geometric average
Hardness	Fox/Wolf River basin hardness summary	Jan. 1998	Jun. 2015	61	Geometric average
Phosphorus	SWIMS - ID 713002, Fox River at Lake Winnebago outlet	May. 2007	Sept. 2017	97	NR 217 rolling median
Cadmium	Wolf River at New London, ambient metals summary	-	-	1	No data available for Fox River
Chromium	Wolf River at New London, ambient metals summary	-	-	1	No data available for Fox River
Copper	Wolf River at New London, ambient metals summary	-	-	1	No data available for Fox River
Lead	Wolf River at New London, ambient metals summary	-	-	1	No data available for Fox River
Nickel	No data available	-	-	1	Assumed to be zero
Mercury	Wolf River at New London, ambient metals summary	-	-	1	No data available for Fox River
Zinc	Wolf River at New London, ambient metals summary	-	-	1	No data available for Fox River
Temperature	NR 102 Table 2	-	-	12	Large warm water
Multiple Dischargers	WPDES viewer	-	-	-	Multiple present but mixing zones do not overlap
Alternative % Low Flow	NR 106.06(4)(c)5	-	-	-	25% Default
Watershed/Basin	SWAMP	-	-	-	Fox River-Appleton/Lower Fox River Basin

		Attachment #3			
HMF Drainage Basin Area	USGS Data - Station NE ¼ of Section 35; T21N – R17E (Appleton)	-	-	1	5,950 mi ² - USGS estimated
Impaired Water Status	WPDES viewer	-	-	-	CWA s. 303(d) - phosphorus, PCBs, TMDL - phosphorus, TSS
Effluent - Little Chute Waterworks					
Annual Average Actual Flow	Permit Application, Discharge monitoring reports	Jan. 2018	Dec. 2018	2	0.0168 (Outfall 001) & 0.0133 (Outfall 002) MGD
Daily Maximum Design Flow	Permit application, permit fact sheet, calculated	-	-	2	Rate changed from 350 to 325 gpm for both outfalls
Actual Flow (Outfall 001)	Discharge monitoring reports	Jul. 2017	Jan. 2020	662	Noncontinuous discharger
Actual Flow (Outfall 002)	Discharge monitoring reports	Jul. 2015	Jan. 2020	1,168	Noncontinuous discharger
TSS	Discharge monitoring reports	Jul. 2015	Jan. 2020	19, 26	Outfall 001, Outfall 002, high value deemed an outlier
Ammonia Chloride (Outfall 001)	Permit application	Oct. 2019	Dec. 2019	4, 4	Outfall 001, Outfall 003
Chloride (Outfall 002)	Discharge monitoring reports	Jul. 2017	Oct. 2019	51, 51	concentration, mass
Hardness	Discharge monitoring reports	Aug. 2015	Oct. 2019	62, 62	concentration, mass
Phosphorus	Permit application	Oct. 2019	Dec. 2019	4, 4	Geometric average - Outfall 001, Outfall 002
Phosphorus (WLA)	Permit application	Oct. 2019	Dec. 2019	5, 5	Outfall 001, Outfall 002
Cadmium	No allocation for phosphorus or TSS	-	-	-	Lower Fox River Basin TMDL
Chromium	Permit application	Oct. 2019	-	1, 1	Outfall 001, Outfall 002
Copper	Permit application	Oct. 2019	-	1, 1	Outfall 001, Outfall 002
Lead	Permit application	Oct. 2019	-	4, 4	Outfall 001, Outfall 002
Nickel	Permit application	Oct. 2019	-	1, 1	Outfall 001, Outfall 002
Mercury	Permit application	Oct. 2019	-	1, 1	Outfall 001, Outfall 002
Zinc	Discharge Monitoring Reports	-	-	0, 0	Not monitored
	Permit application	Oct. 2019	-	1	Outfall 001, Outfall 002

		Attachment #3			
Max Temperature	Permit application	Oct. 2019	-	1, 1	Outfall 001, Outfall 002
pH (Outfall 001)	Discharge monitoring reports	Aug. 2015	Oct. 2019	18	
pH (Outfall 002)	Discharge monitoring reports	Jul. 2017	Oct. 2019	26	
Additives	Permit application	-	-	-	Water source uses chlorine
Effluent Fraction					
Withdraw	Permit application	-	-	-	All effluent is discharged
Water Source					
(Potable)	Permit application	-	-	-	Little Chute Waterworks